

WHAT IS CLAIMED IS:

- 1 1. A probe for deploying electrode arrays, said probe comprising:
2 a shaft having a distal end and a proximal end;
3 a first array of electrodes mounted on the shaft to shift between a retracted
4 configuration and a deployed configuration having a concave face; and
5 a second array of electrodes mounted on the shaft at a location spaced-
6 apart proximally from first array of electrodes, wherein the second electrode array shifts
7 between a retracted and a deployed configuration having a concave face;
8 wherein concave faces are opposed to each other when the arrays are
9 deployed.
- 1 2. A probe as in claim 1, wherein the first and second electrode arrays
2 each comprise a plurality of individual electrodes which initially move axially and then
3 evert as they are deployed.
- 1 3. A probe as in claim 1, wherein the shaft has a self-penetrating tip.
- 1 4. A probe as in claim 1 or 3, wherein the shaft has at least once
2 cavity for receiving the first and second electrode arrays when retracted.
- 1 5. A probe as in claim 1 or 3, wherein the shaft has at least one cavity
2 for receiving the first electrode array when retracted and at least a second cavity for
3 receiving the second electrode array when retracted.
- 1 6. A probe as in claim 1 or 3, further comprising:
2 a first rod connected to the first electrode array and slidably disposed in
3 the shaft, wherein distal advancement of the first rod relative to the shaft causes the first
4 electrode array to deploy distally;
5 a second rod connected to the second electrode array and slidably disposed
6 in the shaft, wherein proximal retraction of the second rod relative to the shaft causes the
7 second electrode array to deploy proximally.
- 1 7. A probe as in claim 1 or 3, wherein the first electrode array spans a
2 planar area in the range between 3 cm² to 20 cm² when deployed, the second electrode
3 array spans a planar area in the range between 3 cm² and 20 cm² when deployed, and the

4 first and second areas are spaced-apart along a line between their respective centers by a
5 distance in the range between 2 cm to 10 cm.

1 8. A probe as in claim 1 or 3, wherein the volume between the first
2 electrode array when deployed and the second electrode when deployed is in the range
3 from 30 cm³ to 150 cm³.

1 9. A probe as in claim 8, wherein the volume is in the range from
2 50 cm³ to 70 cm³.

1 10. A probe as in claim 1 or 3, wherein the first electrode array and
2 second electrode array are electrically isolated from each other, further comprising a first
3 connector for connecting the first electrode array to one pole of a power supply and a
4 second connector for connecting the second array to a second pole of a power supply.

1 11. A probe as in claim 10, further comprising a first axial conductor
2 extending proximally along the shaft from the first electrode array to a location distal to
3 the second electrode array, said first axial conductor being electrically coupled to the first
4 electrode array.

1 12. A probe as in claim 11, wherein the first axial conductor extends
2 proximally beyond the proximal terminus of the first electrode array so that the first axial
3 conductor lies closer to the second electrode array than does any portion of the first
4 electrode array.

1 13. A probe as in claim 11, further comprising a second axial
2 conductor extending distally along the shaft from the second electrode array to a location
3 proximal to the first axial conductor so that a gap exists between the first and second axial
4 conductors, said second axial conductor being electrically coupled to the second electrode
5 array.

1 14. A probe as in claim 13, wherein the second axial conductor extends
2 distally beyond the distal terminus of the second electrode array so that the second axial
3 conductor lies closer to the first electrode array than does any portion of the second
4 electrode array.

1 15. A probe as in claim 13, wherein the distance between the inner
2 termini of the first and second axial conductors is from 0.25 to 0.75 of the distance
3 between the inner termini of the innermost portions of the first and second electrode
4 arrays.

1 16. A method for treating a treatment region in tissue, said method
2 comprising:
3 deploying a first array of electrodes in tissue on one side of the treatment
4 region, wherein said first electrode array has a concave face;
5 deploying a second array of electrodes in tissue along an axis with the first
6 array on another side of the treatment region, wherein said second electrode array has a
7 concave face wherein the concave face of the first electrode array faces the concave face
8 of the second electrode array; and
9 applying electrical current between the first and second electrode arrays.

1 17. A method as in claim 16, wherein deploying the first electrode
2 array comprises introducing a first probe through tissue to a location on one side of the
3 treatment region and advancing a first plurality of at least three electrodes from the probe
4 in an everting pattern.

1 18. A method as in claim 17, wherein deploying the second electrode
2 array comprises advancing a second plurality of at least three electrodes from the probe in
3 an everting pattern at a location on the other side of the treatment region.

1 19. A method as in claim 17, wherein deploying the second electrode
2 array comprises introducing a second probe through tissue to a location on the other side
3 of the treatment region and advancing a plurality of at least three electrodes in an everting
4 pattern.

1 20. A method as in claims 16-19, wherein the tissue is selected from
2 the group consisting of liver, lung, kidney, pancreas, stomach, uterus, and spleen.

1 21. A method as in claim 20, wherein the treatment region is a tumor.

1 22. A method as in claim 16-19, wherein electrical current is applied at
2 a frequency in the range from 300 kHz to 1.2 MHz.

1 23. A method as in claim 22, wherein electrical current is applied at a
2 power in the range from 50W to 300W.

1 24. A method as in claims 16-19, wherein applying electrical current
2 comprises coupling one pole of a radiofrequency power supply to the first electrode array
3 and another pole of the radiofrequency power supply to the second electrode array and
4 energizing the power supply.

1 25. A method as in claims 16-19, wherein the first and second
2 electrode arrays each span a planar area in the range between 3 cm^2 to 20 cm^2 , and
3 wherein the first and second arrays are spaced-apart along a line between their respective
4 centers by a distance in the range between 2 cm to 10 cm.

1 26. A method as in claims 16-19, wherein the tissue volume between
2 the first electrode array and the second electrode is in the range from 30 cm^3 to 150 cm^3 .

1 27. A method as in claim 26, wherein the volume is in the range from
2 50 cm^3 to 70 cm^3 .

1 28. A method as in claims 16-19, wherein said first electrode array
2 includes a first axial conductor extending at least part of the way to the second array
3 along the axis therebetween.

1 29. A method as in claim 28, wherein the first axial conductor extends
2 proximally beyond the proximal terminus of the first electrode array so that the first axial
3 conductor lies closer to the second electrode array than does any portion of the first
4 electrode array.

1 30. A method as in claim 28, wherein said second electrode array
2 includes a second axial conductor extending part of the way to the first array along the
3 axis therebetween and wherein there is a gap between termini of the first axial conductor
4 and the second axial conductor.

1 31. A method as in claim 30, wherein the second axial conductor
2 extends distally beyond the distal terminus of the second electrode array so that the

3 second axial conductor lies closer to the first electrode array than does any portion of the
4 second electrode array.

1 32. A method as in claim 31, wherein the distance between inner
2 termini of the first and second axial conductors is from 0.25 to 0.75 of the distance
3 between the inner termini of the innermost portions of the first and second electrode
4 arrays.

1 33. A method for bipolar radiofrequency necrosis of tissue, said
2 method comprising:

3 deploying a first array of electrodes in tissue on one side of a treatment
4 region, wherein said first array has a transverse face and an axial conductor extending in
5 an axial direction from the transverse face;

6 deploying a second array of electrodes in tissue on another side of the
7 treatment region, wherein said second array has a transverse face and an axial conductor
8 extending in an axial direction opposed to the axial conductor on the first electrode array;
9 and

10 applying bipolar radiofrequency current to the tissue between the first and
11 second electrode arrays.

1 34. A method as in claim 33, wherein deploying the transverse face of
2 the first electrode array comprises introducing a first probe through tissue to a location on
3 one side of the treatment region and advancing a first plurality of at least three electrodes
4 from the probe in a radially diverging pattern.

1 35. A method as in claim 34, wherein the diverging pattern is everting.

1 36. A method as in claim 34 or 35, wherein deploying the transverse
2 second electrode array comprises advancing a second plurality of at least three electrodes
3 from the probe in a radially diverging pattern at a location on the other side of the
4 treatment region.

1 37. A method as in claim 36, wherein the diverging pattern is everting.

1 38. A method as in claim 34 or 35, wherein deploying the transverse
2 face of the second electrode array comprises introducing a second probe through tissue to

3 a location on the other side of the treatment region and advancing a plurality of at least
4 three electrodes in a radially diverging pattern.

1 39. A method as in claim 38, wherein the diverging pattern is everting.

1 40. A method as in claims 33, 34, or 35, wherein the tissue is selected
2 from the group consisting of liver, lung, kidney, pancreas, stomach, uterus, and spleen.

1 41. A method as in claim 40, wherein the treatment region comprises a
2 tumor lesion.

1 42. A method as in claims 33, 34, or 35, wherein the bipolar
2 radiofrequency current is applied at a frequency in the range from 300 kHz to 1.2 MHz.

1 43. A method as in claim 42, wherein the bipolar radiofrequency
2 current is applied at a power in the range from 50W to 300W.

1 44. A method as in claims 33, 34, or 35, wherein applying the bipolar
2 radiofrequency current comprises coupling one pole of a radiofrequency power supply to
3 the first electrode array and another pole of the radiofrequency power supply to the
4 second electrode array and energizing the power supply.

1 45. A method as in claims 33, 34, or 35, wherein the transverse face of
2 the first electrode array spans a planar area in the range between 3 cm^2 to 20 cm^2 , the
3 transverse face of the second electrode array spans a planar area in the range between
4 3 cm^2 and 20 cm^2 , and the first and second arrays are spaced-apart along an axial line
5 between their respective centers by a distance in the range between 2 cm and 10 cm.

1 46. A method as in claim 45, wherein the termini of axial conductors
2 of the first and second electrode arrays are spaced-apart in the axial direction by a
3 distance in the range between 0.5 cm and 5 cm.

1 47. A method as in claim 33, wherein the tissue volume between the
2 transverse face of the electrode array and the transverse face of the second electrode is in
3 the range from 30 cm^3 to 150 cm^3 .

1 48. A method as in claim 33, wherein the distance between the termini
2 of the first and second axial conductors is from 0.25 to 0.75 of the distance between the
3 inner termini of the innermost portions of the first and second electrode arrays.

1 49. A kit for treating a treatment region in tissue, said kit comprising:
2 a first array of electrodes which are deployable in tissue;
3 a second array of electrodes which are deployable in tissue; and
4 instructions for use setting forth a method according to claim 16 or 33.

1 50. A kit as in claim 41, further comprising a package for holding the
2 first electrode array, the second electrode array, and the instruction for use.

1 51. A probe for deploying electrode arrays, said probe comprising:
2 a shaft having a distal end and a proximal end;
3 a first array of electrodes mounted on the shaft to shift between a retracted
4 configuration and a deployed configuration; and
5 a second array of electrodes mounted on the shaft at a location spaced-
6 apart proximally from the first array of electrodes, wherein the second electrode array
7 shifts between a retracted and a deployed configuration;
8 wherein the first array is electrically isolated from the second array to
9 permit the arrays to be connected to a power supply for bipolar operation.

1 52. A probe as in claim 51, wherein the first and second electrode
2 arrays each comprise a plurality of individual electrodes which initially move axially and
3 then evert as they are deployed.

1 53. A probe as in claim 51, wherein the shaft has a self-penetrating tip.

1 54. A probe as in claim 51 or 53, wherein the shaft has at least once
2 cavity for receiving the first and second electrode arrays when retracted.

1 55. A probe as in claim 51 or 53, wherein the shaft has at least one
2 cavity for receiving the first electrode array when retracted and at least a second cavity
3 for receiving the second electrode array when retracted.

1 56. A probe as in claim 51 or 53, further comprising:

2 a first rod connected to the first electrode array and slidably disposed in
3 the shaft, wherein distal advancement of the first rod relative to the shaft causes the first
4 electrode array to deploy distally;

5 a second rod connected to the second electrode array and slidably disposed
6 in the shaft, wherein proximal retraction of the second rod relative to the shaft causes the
7 second electrode array to deploy proximally.

1 57. A probe as in claim 56, wherein the first and second rods may be
2 deployed separately.

1 58. A probe as in claim 51 or 53, wherein the first electrode array
2 spans a planar area in the range between 3 cm^2 to 20 cm^2 when deployed, the second
3 electrode array spans a planar area in the range between 3 cm^2 and 20 cm^2 when
4 deployed, and the first and second areas are spaced-apart along a line between their
5 respective centers by a distance in the range between 2 cm to 10 cm.

1 59. A probe as in claim 51 or 53, wherein the volume between the first
2 electrode array when deployed and the second electrode when deployed is in the range
3 from 30 cm^3 to 150 cm^3 .

1 60. A probe as in claim 59, wherein the volume is in the range from
2 50 cm^3 to 70 cm^3 .

1 61. A probe as in claim 51 or 53, wherein the first electrode array and
2 second electrode array are electrically isolated from each other, further comprising a first
3 connector for connecting the first electrode array to one pole of a power supply and a
4 second connector for connecting the second array to a second pole of a power supply.

1 62. A probe as in claim 61, further comprising a first axial conductor
2 extending proximally along the shaft from the first electrode array to a location distal to
3 the second electrode array, said first axial conductor being electrically coupled to the first
4 electrode array.

1 63. A probe as in claim 62, wherein the first axial conductor extends
2 proximally beyond the proximal terminus of the first electrode array so that the first axial

3 conductor lies closer to the second electrode array than does any portion of the first
4 electrode array.

1 64. A probe as in claim 62, further comprising a second axial
2 conductor extending distally along the shaft from the second electrode array to a location
3 proximal to the first axial conductor so that a gap exists between the termini of the first
4 and second axial conductors, said second axial conductor being electrically coupled to the
5 second electrode array.

1 65. A probe as in claim 64, wherein the second axial conductor extends
2 distally beyond the distal terminus of the second electrode array so that the second axial
3 conductor lies closer to the first electrode array than does any portion of the second
4 electrode array.

1 66. A probe as in claim 64, wherein the distance between the inner
2 termini of the first and second axial conductors is from 0.25 to 0.75 of the distance
3 between the inner termini of the innermost portions of the first and second electrode
4 arrays.